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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/786,550	YUAN ET AL.	
	Examiner	Art Unit	
	LI LIU	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13-16,19,21 and 23-35* is/are rejected.

7)☒ Claim(s) *12,17,18,20 and 22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 March 2004 and 20 July 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1, 14, 27 and 31 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 5, 7-11, 13-16, 23-25, 27-32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blow (US 5,757,912) in view of Shields et al (US 2002/0196827) and Rosenfeldt (US 2003/0043467).

1). With regard to claim 1 and 27, Blow disclose a photon emitter comprising:

a photon generator (e.g., laser 51 in Figure 5a) configured to generate polarized photons separable into a first polarisation state and a second polarisation state, the first polarisation state being orthogonal to the second polarisation state (any polarization state can be projected onto two orthogonal polarization states, or any polarization state can be viewed as the combination of two orthogonal polarized states with a specific phase differences; and the photons from the laser 51 can be separated into two orthogonal polarization states); and

time delay means (as shown in Figure 5a, or Time Delay as shown in following Figure O1) being configured to delay one split photon such that two photons exit the time delay means at different times.

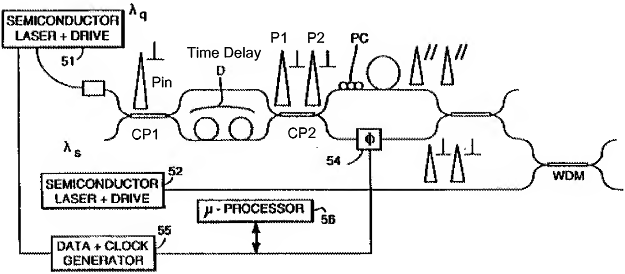

Figure O1

But, Blow does not expressly disclose the photon generator configured to generate randomly polarized photons, and the time delay means being configured to receives randomly polarized photons and delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarization.

However, Shield et al discloses a photon generator configured to generate randomly polarized photons (e.g., device 501 in Figure 26, [0039] and [0040], [0262]),

the orientation of the polarisation was randomly selected for each pair of photons emitted from the decay of biexcitons at different times); and then a polarization beam splitter is configured to receives randomly polarized photons.

But, Shield et al does not expressly state that one path is delayed with respect to another path.

However, Rosenfeldt teaches a time delay means (e.g., 102 in Figures 1 and 2) which is configured to delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarisation (Figures 1 and 2, PBS 104 splits the signal into two paths; 18a and 18b, and path 18b passes through delay loop 108 then to PBS 106 or coupler 302. Then, the photons in the first polarization exit the time delay means at a different time to photons with the second polarisation).

As disclosed by Blow, Figure 5a, only one polarization is used in the transmitter; and the two pulses after the time delay device are from the pulse of same polarization (Pin shown in Figure O1), the total power of each pulse (P1 or P2) is only half of the Pin. That is, the power of laser is not fully utilized. With the teaching of Shield et al and Rosenfeldt, both polarization states of the laser output can be used.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the randomly polarized photon generator and the time delay arrangement as taught by Shield et al and Rosenfeldt to the system of Blow so that the two polarizations of the laser output can be used, the power is more

efficiently used, and the intensity of photons in each photons after the delay means can be increased.

2). With regard to claim 2, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the time delay means comprises a polarising beamsplitter (e.g., Rosenfeldt: PBS 104 in Figures 1 and 2) which directs photons having the first polarisation state along a first path (18a in Figures 1 and 2) and photons having the second polarisation state along a second path (18b in Figures 1 and 2) and combining means (e.g., PBS 106 in Figure 1 or coupler 302 in Figure 2) to combine the first and second paths, one of the paths being longer than the other path (Figures 1 and 2, the path 18b is longer that the path 18a).

3). With regard to claim 3, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above, and Blow and Shield et al and Rosenfeldt further disclose wherein one of the paths is provided with means (e.g., Rosenfeldt: the 90 degree rotator 304 in Figure 2) to rotate the polarisation of photons passing through said path such that photons from the first path and the second path at the combining means have the same polarization (by rotating the photons in path 18b, the polarizations of the two path are the same at the coupler 302, [0026]).

4). With regard to claim 5, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above, and Blow and Shield et al and Rosenfeldt further disclose wherein photons which have passed through the time delay

means are passed into an encoding means (Figure 5a or Figure O1, the encoder with delay and phase modulator 54).

5). With regard to claim 7, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 1 and 5 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the encoding means (Blow: phase modulator 54; Figure 5a) are configured to encode the phase of a photon and comprise an interferometer (the interferometer with loop delay and phase modulator 54), said interferometer comprising an entrance coupler (the coupler before the interferometer, Figure 5a) connected to a long arm (Figure 5a, the branch with delay loop) and a short arm (Figure 5a, the branch with phase modulator), said long arm and short arm being joined at their other ends by an exit coupler (Figure 5a, the coupler after the interferometer), one of said arms a having phase modulator (54 in Figure 5a) which allows the phase of a photon passing through that arm to be set to one of at least two values (phase modulator can module the phase of the polarized beam to 0 or π etc; column 4, line 48 to column 5 line 14, column 9 lines 5-20; column 11, Tables 1 and 2).

6). With regard to claim 8, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 1, 5 and 7 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the time delay means comprises a polarising beamsplitter (e.g., Rosenfeldt: Figures 1 and 2, PBS 104) which directs photons having the first polarisation state along a first path (e.g., 18a in Figues 1 and 2) and photons having the second polarisation state along a second path (e.g., 18b in Figures 1 and 2) and combining means to combine the first and second paths (e.g., PBS 106 or coupler

302 combines the first and second paths), one of the paths being longer than the other path (e.g., 18b is longer than non-delayed path), and wherein said entrance coupler has first and second inputs (Blow: coupler CP2 shown in Figure O1, the entrance coupler is the same coupler for combining the first and second paths, the first and second inputs of the entrance coupler accept the outputs from the first and second paths) and first and second outputs (the coupler CP2 has two outputs), wherein the first and second outputs are connected to the long arm and short arm of the interferometer (Figure 5a or Figure O1 above, the outputs of the coupler CP2 are connected to the two arms of the interferometer), and photons which pass through the first path and second path are coupled into the same input of the entrance coupler (Figure 5a or Figure O1, the photons from the first path and second path are combined and coupled to the same input of the entrance coupler).

7). With regard to claim 9, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 1, 5, 7 and 8 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the phase modulator (Blow: the phase modulator 54 in Figure 5a) is capable of providing a different modulation to photons which pass through the first path than those which path through the second path, such that photons generated with the first or second polarisation state exit the interferometer with the same phase state (Blow discloses that each pulse can be individually modulated, column 4 line 48 to column 5 line 14, and Table 1 and Table 2, the pulses from two sources or the two pulses from the time delay devices can be modulated to have the same phase state).

8). With regard to claim 10, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 1, 5 and 7 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the time delay means comprises a polarising beamsplitter (e.g., Rosenfeldt: Figures 1 and 2, PBS 104) which directs photons having the first polarisation state along a first path (e.g., 18a in Figues 1 and 2) and photons having the second polarisation state along a second path (e.g., 18b in Figures 1 and 2) and combining means to combine the first and second paths (e.g., PBS 106 or coupler 302 combines the first and second paths), one of the paths being longer than the other path (e.g., 18b is longer than non-delayed path), and wherein said entrance coupler has first and second inputs (Blow: coupler CP2 shown in Figure O1, the entrance coupler is the same coupler for combining the first and second paths, the first and second inputs of the entrance coupler accept the outputs from the first and second paths) and first and second outputs connected (the coupler CP2 has two outputs for the encoder), wherein the first and second outputs are connected to the long arm and short arm of the interferometer (Figure 5a or Figure O1 above, the outputs of the coupler CP2 are connected to the two arms of the interferometer), and said entrance coupler also provides the combining means for the first path and second path such that photons which follow the first path enter the entrance coupler by the first input (Figure 5a, the photons from the first path enter the first input, e.g., the upper entrance of the coupler CP2) and photons which follow the second path enter the entrance coupler by the second input (Figure 5a or Figure O1, the photons from second path enter the second input, e.g., the lower entrance of the coupler CP2).

9). With regard to claim 11, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 1 and 5 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the photon are encoded using polarization (e.g., Shields et al: Figures 25 and 26, the variable retarder 529 encodes the photons using polarization, [0262]-[0271]).

10). With regard to claim 13, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above, and Blow and Shield et al and Rosenfeldt further disclose means (e.g., Rosenfeldt: Figure 4, the 90 degree rotator 304 in Figure 2) to rotate the polarisation of the delayed photons such that photons are emitted having the same polarization (by rotating the photons in path 18b, the polarizations of the two path are the same at the coupler 302, [0026]).

11). With regard to claim 14, Blow disclose a quantum communication system (Figure 5a and 5b) comprising:

a photon emitter (the transmitter, Figure 5a) comprising:

a photon generator (e.g., laser 51 in Figure 5a) configured to generate polarized photons separable into a first polarisation state and a second polarisation state, the first polarisation state being orthogonal to the second polarisation state (any polarization state can be projected on to two orthogonal polarization states, or any polarization state can be viewed as the combination of two orthogonal polarized states with a specific phase differences; and the photons from the laser 51 can be separated into two orthogonal polarization states); and

time delay means (as shown in Figure 5a, or Time Delay as shown in Figure O1 above) being configured to delay one split photon such that two photons exit the time delay means at different times, and the two photons temporally separated enter an encoding means; and

encoding means (Figure 5a or Figure O1, the encoder with delay and phase modulator 54), wherein photons which have passed through the time delay means are passed into the encoding means (the photons from the time delay means are passed in the encoding means);

the communication system further comprising a receiver (Figure 5b) having means to decode the photons (the decoder with the delay and modulator 58, Figure 5b) and a detectors (e.g., APD 601 and 602).

But, Blow does not expressly disclose the photon generator configured to generate randomly polarized photons, and the time delay means being configured to receives randomly polarized photons, and wherein photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarization, and photons with the first polarization are temporally separated from photons with the second polarization when entering the encoding means.

However, Shield et al discloses a photon generator configured to generate randomly polarized photons (e.g., device 501 in Figure 26, [0039] and [0040], [0262]), the orientation of the polarisation was randomly selected for each pair of photons

emitted from the decay of biexcitons at different times); and then a polarization beam splitter is configured to receives randomly polarized photons.

But, Shield et al does not expressly state that one path is delayed with respect to another path.

However, Rosenfeldt teaches a time delay means (e.g., 102 in Figures 1 and 2) which is configured to delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarisation (Figures 1 and 2, PBS 104 splits the signal into two paths; 18a and 18b, and path 18b passes through delay loop 108 then to PBS 106 or coupler 302. Then, the photons in the first polarization exit the time delay means at a different time to photons with the second polarisation), and photons with the first polarization are temporally separated from photons with the second polarization when entering a measuring device.

As disclosed by Blow, Figure 5a, only one polarization is used in the transmitter; and the two pulses after the time delay device are from the pulse of same polarization (Pin shown in Figure O1), the total power of each pulse (P1 or P2) is only half of the Pin. That is, the power of laser is not fully utilized. With the teaching of Shield et al and Rosenfeldt, both polarization states of the laser output can be used.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the randomly polarized photon generator and the time delay arrangement as taught by Shield et al and Rosenfeldt to the system of Blow

so that the two polarizations of the laser output can be used, the power is more efficiently used, and the intensity of photons in each photons after the delay means can be increased.

12). With regard to claim 15, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 14 above, and Blow and Shield et al and Rosenfeldt further disclose wherein said encoding means are configured to encode the phase of a photon (Blow: phase modulator, 54 in Figure 5a) and comprise a first interferometer (the interferometer with loop delay and phase modulator 54), said interferometer comprising an entrance coupler (coupler CP1 as shown in Figure O1) connected to a long arm (Figure 5a, the branch with delay loop) and short arm (Figure 5a, the branch with phase modulator), said long arm and short arm being joined at their other ends by an exit coupler (Figure 5a, the coupler after the interferometer), one of said arms having phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values (the phase modulator can module the phase of the polarized beam to either 0 or π etc, column 9 lines 5-20; column 11, Table 1 and Table 2), the receiver comprising a second interferometer (Figure 5b, the interferometer on Detector side), the second interferometer comprising an entrance coupler (Figure 5b, the coupler just before the interferometer) connected to a long arm (Figure 5b, the arm with the delay loop) and a short arm (the arm with modulator 58), said long arm and short arm being joined at their other ends by an exit coupler (Figure 5b, the coupler before the detector APDs), one of said arms having second phase variation means (58 in Figure 5b) which allows the phase of a photon

passing through that arm to be set to one of at least two values (the phase modulator can module the phase of the polarized beam to either 0 or π etc, column 4, line 48 to column 5 line 14, column 9 lines 5-20; column 11, Table 1 and Table 2)

13). With regard to claim 16, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 14 and 15 above, and Blow and Shield et al and Rosenfeldt further disclose directing means (Blow: Figure 5b, the combination of polarization controller and coupler before the interferometer in the Detector) configured to ensure that photons which have passed through the short arm of the first interferometer are directed down the long arm of the second interferometer and photons which have passed through the long arm of the first interferometer pass through the short arm of the second interferometer (Blow: as shown in Figure 5a-b, pulses with superscript "//" are going through the long arm and pulses with superscript $\perp$ are going through the short arm of the interferometer in the Transmitter, while those same pulses with superscript "//" are going through the short arm and pulses with superscript $\perp$ are going through the long arm, of the interferometer in the Detector; column 9 lines 5-40).

14). With regard to claim 23, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 14 above, and Blow and Shield et al and Rosenfeldt further disclose means to communicate a clock signal between emitter and receiver (Blow: laser 52 in Figure 5a provides clock signal column 9 lines 15-20).

15). With regard to claim 24, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 14 above, and Blow and Shield et al and Rosenfeldt further disclose wherein a clock pulse is sent from the emitter to the receiver

with each photon from the generator (Figure 5a and 5b, the laser 52 generates another wavelength signal for carrying the timing information from the transmitter to the detector; the signal is used for timing and calibration; and the system clock is sent to the receiver for synchronisation of the transmitter and receiver time-slots, column 7 line 45-46, and the clock pulse is with each photon from the generator so that the relative phase shift in the interferometer can be calibrated, column 9 lines 15-20).

16). With regard to claim 25, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 14 and 24 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the clock signal has a different wavelength to the photons emitted from the photon generator (the second laser 52, generate another wavelength signal for carrying the timing information from the transmitter to the detector; column 9 lines 15-20).

17). With regard to claim 28, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 27 above, and Blow and Shield et al and Rosenfeldt further disclose separating photons having the first polarisation state from those having the second polarisation state (Rosenfeldt: Figures 1 and 2, the PBS 104 separates photons having the first polarisation state from those having the second polarisation state).

18). With regard to claim 29, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 27 above, and Blow and Shield et al and Rosenfeldt further disclose rotation the polarization of the delay photons by 90^{o} (e.g., Rosenfeldt: the 90 degree rotator 304 in Figure 2).

19). With regard to claim 30, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 27 above, and Blow and Shield et al and Rosenfeldt further disclose the method comprising passing photons through an interferometer (Blow: the interferometer with delay loop and modulator in Figure 5a) and modulating (the modulator 54 in Figure 5a) the delayed photons as they pass through the interferometer such that photons which initially had the first and second polarisation states emerge from the interferometer with the same phase state (Blow discloses that each pulse can be individually modulated, column 4 line 48 to column 5 line 14, and Table 1 and Table 2, the pulses from two sources or the two pulses from the time delay devices can be modulated to have the same phase state).

20). With regard to claim 31, Blow disclose a polarization distinguisher for a photon generator (e.g., laser 51 in Figure 5a) configured to generate polarized photons separable into a first polarisation state and a second polarisation state (any polarization state can be projected on to two orthogonal polarization states, or any polarization state can be viewed as the combination of two orthogonal polarized states with a specific phase differences; and the photons from the laser 51 can be separated into two orthogonal polarization states), said distinguisher comprising:

time delay means (as shown in Figure 5a, or Time Delay as shown in following Figure O1) being configured to delay one split photon such that two photons exit the time delay means at different times.

However, Blow does not expressly disclose the photon generator configured to generate randomly polarized photons, and the time delay means receiving the randomly

polarized photons and being configured to delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarization.

However, Shield et al discloses a photon generator configured to generate randomly polarized photons (e.g., device 501 in Figure 26, [0039] and [0040], [0262]), the orientation of the polarisation was randomly selected for each pair of photons emitted from the decay of biexcitons at different times); and then a polarization beam splitter is configured to receives randomly polarized photons.

But, Shield et al does not expressly state that one path is delayed with respect to another path.

However, Rosenfeldt teaches a time delay means (e.g., 102 in Figures 1 and 2) which is configured to delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarisation (Figures 1 and 2, PBS 104 splits the signal into two paths; 18a and 18b, and path 18b passes through delay loop 108 then to PBS 106 or coupler 302. Then, the photons in the first polarization exit the time delay means at a different time to photons with the second polarisation).

As disclosed by Blow, Figure 5a, only one polarization is used in the transmitter; and the two pulses after the time delay device are from the pulse of same polarization (Pin shown in Figure O1), the total power of each pulse (P1 or P2) is only half of the

Pin. That is, the power of laser is not fully utilized. With the teaching of Shield et al and Rosenfeldt, both polarization states of the laser output can be used.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the randomly polarized photon generator and the time delay arrangement as taught by Shield et al and Rosenfeldt to the system of Blow so that the two polarizations of the laser output can be used, the power is more efficiently used, and the intensity of photons in each photons after the delay means can be increased.

21). With regard to claims 32 and 34, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 27 and 31 above, and Blow and Shield et al and Rosenfeldt further disclose wherein the photon generator comprising a single photon source (Blow: Figures 4a and 4b, single photon source, and column 6, line 58-62; or Shield et al: [0263]).

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blow and Shields et al and Rosenfeldt as applied to claim 1 above, and in further view of Townsend (US 6,529,601).

Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above. But Blow and Shield et al and Rosenfeldt do not expressly disclose wherein the time delay means comprises a single path configures to allow photons having a first polarization state to travel at a different speed to photons with a second polarization state.

However, Townsend, in the same field of endeavor, teaches a time delay means (Figures 4-7) comprises a single path (the polarization maintaining fiber PM shown in Figures 4 and 5) configures to allow photons having a first polarization state to travel at a different speed to photons with a second polarization state (as shown in Figures 4 and 5, the photons having a polarization aligned with the fast axis travel at a different speed to photons with a polarization state aligned with slow axis).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the polarization arrangements of clock signal and data signals as taught by Townsend to the system of Blow and Shield et al and Rosenfeldt so that a simple single path delay line can be obtained, and the system is less complicated.

5. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blow and Shields et al and Rosenfeldt as applied to claim 1 above, and in further view of Moeller et al (US 6,538,787).

Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 1 above. But Blow and Shield et al and Rosenfeldt do not expressly disclose wherein the encoding means is capable of performing a different encoding operation on photons with the first polarisation state than those with the second polarisation state.

However, Moeller et al discloses an encoding means capable of performing a different encoding operation on photons with the first polarisation state than those with the second polarisation state (Figure 6; polarization beam-splitter splits the signal into two polarized beam going to separate branch. A phase modulator 603, 605 is located in

each branch, and perform different modulation on the two polarized beam; column 7 lines 50-67).

Therefore, it would have been obvious for a person of ordinary skill in the art at the time of the invention to incorporate the teachings of Moeller et al with Blow and Shield et al and Rosenfeldt so to improve data transmission capabilities and enhance the coding formats.

6. Claims 19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blow and Shields et al and Rosenfeldt as applied to claim 14 above, and in further view of Paradiso et al (US 7,109,865).

1). With regard to claim 19, Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claim 14 above. But, Blow and Shield et al and Rosenfeldt do not expressly disclose the system comprising means to apply a gating signal to a detector, the gating signal being provided to switch the detector between an "on mode" where photons may be detected and an "off mode" where photons may not be detected.

However, as disclosed by Blow, the bias supply 60 is used to control the detectors 601 and 602, that is, a receiving state and non-receiving state can be controlled by the bias supply (column 9 lines 32-40).

Another prior art, Paradiso et al, discloses a system and method to apply a gating signal (e.g., the WAKEUP GATE in Figure 1) to a processor, the gating signal being provided to switch the processor between an "on mode" (the wake up mode,

column 4 line 32-46) where photons may be detected and an “off mode” (the low-power shutdown mode, column 4 line 32-46) where photons may not be detected.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the two mode mechanism as taught by Paradiso et al to the system of Blow and Shield et al and Rosenfeldt so that the system can consume less power, and the background noise can be reduced and signal to noise ratio can be enhanced.

2). With regard to claim 21, Blow and Shield et al and Rosenfeldt and Paradiso et al disclose all of the subject matter as applied to claims 14 and 19 above, and Blow and Shield et al and Rosenfeldt and Paradiso et al further disclose wherein the detector is in an "on mode" for the two intervals (Blow: Figure 5b, time for two pulses) when a photon is expected after following the first or second path in the time delay means (Blow: there are two pulses for each branch, as shown in Figure 5b; thus the detector must be in receiving state for the period of two pulses, column 9 lines 32-40).

7. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Blow and Shields et al and Rosenfeldtas applied to claim 14 above, and in further view of Huang (US 5,329,393)

Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 14 and 24 above. But Blow and Shield et al and Rosenfeldt do not expressly state wherein the clock signal has a different polarisation to that of the photons sent to the receiver from the photon generator.

However, Huang teaches a system wherein the clock signal has a different polarisation to that of the photons sent to the receiver from the data signal (column 7, line 2-3).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the polarization arrangements of clock signal and data signals as taught by Huang to the system of Blow and Shield et al and Rosenfeldt so that the interference between the clock signal and the data signal can be reduced.

8. Claims 33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Blow and Shields et al and Rosenfeldtas applied to claims 27, 31, 32 and 34 above, and in further view of Hughes et al (US 5,966,224).

Blow and Shield et al and Rosenfeldt disclose all of the subject matter as applied to claims 27, 31, 32 and 34 above. But Blow and Shield et al and Rosenfeldt do not expressly disclose wherein the single photon source emits a single photon pulse having a duration in a range of 100 ps to 1 ns.

However, Hughes et al, in the same field of endeavor, teaches a single photon source that emits a single photon pulse having a duration around 100 ps (column 3, line 57). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the short pulse as taught by Hughes et al to the system of Blow and Shield et al and Rosenfeldt so that the a high data rate can be obtained.

Allowable Subject Matter

9. Claims 12, 17, 18, 20 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/L. L./
Examiner, Art Unit 2613
December 21, 2008

/Kenneth N Vanderpuye/
Supervisory Patent Examiner, Art Unit 2613